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A WATER REVIEW QUARTERLY

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May 1972

May 1972 Vol. 58, No. 2

RECLAMATION era

Kathleen Wood Loveless, Editor

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COVER. Boating is only one of the fine sports enjoyed on the many Bureau of Reclamation reservoirs. Here, on Grand Lake, Colorado-Big Thompson project, sailboating is a favorite sport.

United States Department of the Interior
Rogers C. B. Morton, Secretary

Bureau of Reclamation, Ellis L. Armstrong
Commissioner

Issued quarterly by the Bureau of Reclamation, United States Department of the Interior, Washington, D.C. 20240. Use of funds for printing this publication approved by the Director of the Bureau of the Budget, August 14, 1969.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price 45 cents (single copy). Subscription price: $1.50 per year (50 cents additional for foreign mailing).

COMMISSIONER'S PAGE

Reclamation's Recreation

With the multitude of labor-saving devices man has created to facilitate nearly every facet of life, he has more leisure time than ever before. The recent Congressional action moving national holidays to provide 3-day weekends and the proposed 4-day, 40-hour week, reflect the trend of the future.

It is no wonder our recreational areas are increasing in number and in visitor days per area to meet the demands of increased leisure time. Between 1958 and 1970 visitor days of recreation use at Bureau of Reclamation projects increased from 19.5 million to 55.2 million.

In the process of providing water users with vitally needed water for irrigation, industrial and municipal uses, the Bureau of Reclamation has created 242 recreational spots most ideal for fishing, boating, water skiing, picnicking, sightseeing, and hunting.

Each recreational area has its own forte. For example, in the far Northwest, Banks Lake and the Potholes on the Columbia Basin project are notable for hunting and year-round trout fishing. In the more than 100 lakes on the project, there also is superior spinyray fishing. The Washington State Game Department stocks and manages these lakes. It reports the new lakes on the Columbia Basin project are among the best trout-producing lakes in Washington State.

This project also is one of the most popular areas for migratory waterfowl hunting and is becoming the major pheasant hunting area of the State.

Boating, water skiing, swimming, fishing, sightseeing and camping annually attract many outdoorsmen. Floating the Green River below the Bureau's Flaming Gorge Dam is a popular activity. The river is fed by the clear cold water from the dam and it teems with rainbow, brown, and native cutthroat trout.

As the recreation season approaches, we hope you will take advantage of the recreational benefits Bureau of Reclamation projects have to offer.

ELLIS L. ARMSTRONG
Commissioner of Reclamation

Utah's "Dead Sea" Is Still Alive

HALF a world and a mile of elevation lie between Palestine's Dead Sea and Utah's Great Salt Lake, yet there are striking similarities between the two.

Both are fed by a nearby fresh-water lake, and by a river named Jordan. Nature has denied each an outlet, resulting in an unusually heavy salt content in their waters.

Because each is a unique natural phenomenon, located near other attractions of both scenic and historic nature, tourists throng to these briny seas, drawn in great measure by the enthralling prospect of bobbing like corks atop water in which it is difficult—if not downright impossible—to sink.

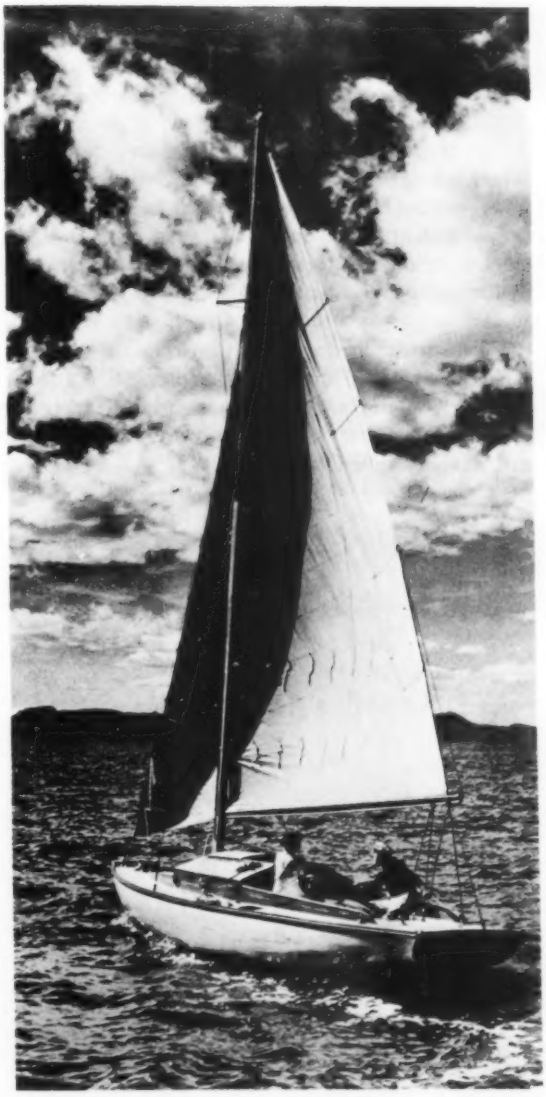
Mineral salts abound in the waters of both and, because they are both known as "dead" seas, a store of legend and myth has grown up concerning them.

But there are also significant differences between the mountain-fringed lake in Utah and its desert-bound Middle Eastern cousin.

For one thing, Utah's "Dead Sea" is very much alive!

Short miles to the east, guarded by the towering ramparts of the snow-mantled Wasatch Mountain range, lies Utah's capital city, a thriving, modern metropolis which derives its name from the lake with which it shares a valley.

On the western shore of the lake, where the salt desert spreads its flat terrain toward Nevada, a $70 million plant is under construction to extract magnesium salts from the briny waters for use in manufacture of magnesium.



Sailboating on Great Salt Lake provides visitors a refreshing and relaxing activity. ***Photo courtesy Utah Travel Council***

Reclamation's Willard Bay

Midway along the east shore of the lake, Bureau of Reclamation engineers have erected a 14-mile dike to impound freshwater flowing down through mountain canyons to form the Willard fresh water bay which is providing new recreational possibilities as well as meeting irrigation needs.

And planners from government and private industry are mapping new blueprints to make Utah's inland sea a more viable part of the State's economy.

An air of mystery and legend has always surrounded the natural lake, largest in the United States west of the Mississippi. Long before mountain man Jim Bridger explored the lake in 1824, rumors of this body of water had mushroomed into fantastic stories that became part of early American folklore.

The largest remnant of a great fresh water lake which once covered the Salt Lake Valley and much of western Utah, the Great Salt Lake now is 75 miles in length, 50 miles wide and covers 1,500 square miles. Its waters are roughly 25 percent salt, nearly 8 times the saline content of ocean water.

Western explorers John C. Fremont and Jim Bridger explored much of this lake in a rubber boat in 1843, in the process laying to rest Bridger's original idea that he had "discovered an inland arm of the Pacific Ocean."

Cannot Sink

Since Brigham Young and some of the early Mormon pioneers first swam in the lake in 1847, discovering to their delight that one could float freely on its waters without the slightest fear of sinking, the lake has become famous for swimming. Many visitors to the Salt Lake Valley still take advantage of the several south shore beaches to bob buoyantly on its surface.

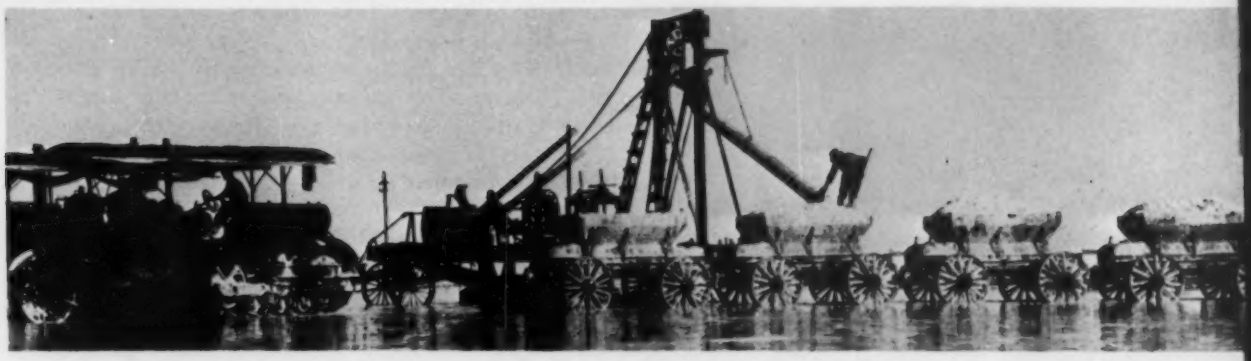
Despite this great natural attraction, however, the fluctuating levels of the lake have made it difficult to establish permanent bathing facilities on the lake shores. Over the years, numerous such resorts have been founded, enjoyed various periods of prosperity, then faded when the receding waters left the resorts high and dry. In a few rare instances, the resorts have even been flooded when heavy precipitation caused an unusual rise in the water level.

The Great Saltair

Most famous of the Great Salt Lake resorts was Saltair, built in 1893 when the lake was reasonably high and water splashed against the pilings which supported the resort pavilions. In its heydey, Saltair provided visitors a variety of entertainment and its dance pavilion and roller coaster were famous throughout the Mountain West and much of the country.

From the turn of the century until 1930, with

Even bathers of the early 1900's found sinking in the Lake nearly impossible. ***Photo courtesy of Utah Travel Council***



One of Utah's earliest industries was extraction of salt from lake brine. Here salt is loaded onto old-time carriers. *Photo courtesy Utah Travel Council*

the exception of a few years between 1900 and 1910, reasonably high water levels kept the resort in profitable operation. But between 1930 and 1940, hard times fell upon the famed resort. During this decade, the lake dropped to its lowest recorded levels and the water receded to several hundred yards from the pavilion.

With the rise of the lake during the 1940's Saltair again enjoyed a brief resurgence as a resort, but then the waters again receded and the once-proud resort fell into disuse. Repeated fires scorched this grand "lady of the lake" and last summer a violent blaze completely gutted the structure. Despite efforts of private groups to save her, the majestic Saltair Pavilion never again will reign over the Great Salt Lake.

Particularly in recent years, as Utah came into her own as an industrial state, attracting new population and business ventures, plans have been broached and blueprints prepared to build new and modern developments on the shore of the lake—mainly on the Salt Lake City end—but they proved to be more a dream than a reality.

Still, the lake continually stirs hopes of Utahans that someday it may become a major recreation area, although, considerable recreational opportunities exist now.

The high salt content of the water makes the lake unusable for such aquatic sports as water skiing, but winds which sweep out of the mountain canyons to the east and sometimes blow north or south along the valley floor provide adequate breeze-power for a good many sailboats.

If and when plans for developing new beaches on Antelope Island, which lies in the lake northwest of Salt Lake City, are brought to fruition by either Government or private developers, boating may become far more popular.

A State park now exists on the northern tip of Antelope Island and a rough causeway supports a road which links the island to the valley land. But lack of funds has stymied efforts to build a modern, all-weather causeway, and violent storms which often whip the lake pose a constant threat and often wash away sections of the road and dike.

Proposed National Monument

Some State leaders and members of the State's Congressional delegation have proposed national

Hydroplane racing provides excitement for spectators at Willard Bay, Weber Basin project.

The *General James A. Garfield* (1921) proudly reigns over the salty Utah waters.

monument status for Antelope Island, complete with the development of bathing beaches and construction of dikes which would turn the southeastern portion of the lake into a fresh-water pond.

Man has already proved that such dikes are not only possible but feasible. Some 12 miles northwest of the city of Ogden, which is about 45 miles north of Salt Lake City, a 14½-mile earthfill structure, 36 feet in height, runs in a rough rectangle enclosing a bay of the lake which holds 215,000 acre-feet of fresh water when filled to capacity.

It is here that much of the water activity on the lake takes place. Sailboats dot the surface of Willard Bay on breezy days. Motorboats tow water skiers in graceful patterns and, at times, speedboats slice the bay's surface in well-attended boat race events.

In recent years, navigability of the lake has been a central question in legal disputes between the State of Utah and the Federal Government over ownership of the lake's shore lands.

At one time, boats of considerable size regularly plied commercial routes on the Great Salt Lake. In 1902, officials of the Southern Pacific Railroad embarked on an ambitious task. Engineers of the firm decided to build a causeway across a 40-mile section of the lake to shorten the rail route between the transportation hub of Ogden and the western shore of the lake. During construction of this famed "Lucin cutoff," barges loaded with construction materials regularly sailed the lake.

But long before this, a variety of vessels used the lake waterway for a number of purposes. In 1848, a group of Mormon pioneers used boats to conduct a major exploration of the entire lake. Boats became the principal method in the 1850's for ferrying livestock to and from ranching operations on Antelope Island.

The Lake's Vessels

Then, in 1871, the biggest vessel to use the Great Salt Lake hauled ore from the mines at the south end of the lake to a smelter located at Corinne, on the northern shore. Named *City of Corinne*, this vessel was a 240-ton, Mississippi River-type stern-wheeler. When the short-lived commercial venture failed, the *City of Corinne* was converted into a pleasure boat and for many years sailed the lake, making regular stops at various resorts.

One one such cruise, as the story goes, a noted visitor to Utah used a trip on the *City of Corinne* to indicate he might become a candidate for the Presidency of the United States. Whether the tale is true or not, the vessel was renamed in honor of the distinguished passenger and cruised the lake for years under the name of *General James A. Garfield.*

Not as majestic as the *General James A. Garfield*, but for children this "sea monster" is every bit as enjoyable. *Photo courtesy Utah Travel Council*

N.L. Industries, one of the world's largest producers of magnesium metal, is on the southwest shore of Great Salt Lake. *Photo courtesy N.L. Industries.*

Commercial ventures on or near the Great Salt Lake have been many and varied over the years. One of Utah's earliest industries was extraction of salt from lake brine, and today at least three major salt companies have operations on the south shore. It is estimated that the lake contains 8 billion tons of salt. But, in spite of the vast natural resources here, Utah produces only about 1 percent of the Nation's salt supply.

Potash has been produced near the lake for years, but the industry really took hold in the 1930's and is a significant contributor to the region's economy.

Brightest hope for the future of the lake is its vast store of mineral salts.

Potential Industrial Site

Industries are looking to the lake as a source of magnesium chloride, sodium sulphate, potassium chloride, and lithium chloride. In the eyes of many, the lake is a mineral storehouse of untold potential which may yet prove of great and lasting economic benefit.

One company which obviously believes this is N.L. Industries. It has under construction along the lake's west shore a $70 million plant to take magnesium salts from the water for commercial and industrial use.

An early industrial development dream involving the lake is extraction of oil from the briny waters.

Way back in 1861, an army battalion camped near Promontory, Utah—the spot where the transcontinental railroad link was first established—found oil at Rozel Point.

This mysterious oil supply has puzzled geologists and frustrated every attempt to extract it from the lake. Some 32 holes have reportedly been sunk into the lake bottom in this area, in what is possibly the only off-shore oil drilling operation in water surrounded by an American desert.

Some estimates have it that 21 million barrels of crude oil lie beneath the lake. This oil is very thick, oozes to the surface occasionally in warm weather and often forms a gooey carpet of tar on the lake bottom. It is so thick that it is almost impossible to pump by ordinary means, but this has not discouraged efforts to tap the oil reserve.

Meanwhile, the lake remains a resource of obviously great value, its potential largely as yet unrealized, but waiting for the right circumstances to become an even greater asset. # # #

This young lady finds reading the newspaper easy while floating on Utah's salty lake.

by C. R. (Bob) WHITMORE
Specifications and Procurement Branch
E&R Center, Denver, Colo.

LOST IN THE WILDERNESS

WHEN I began teaching hunter safety for the Colorado Game, Fish, and Parks Department, I never dreamed that a few years later I'd be up there near the timberline—cold, hungry, and lost.

I especially never dreamed that I would have put myself there deliberately in 1971, with seven companions who must have been doubting their good sense, too.

We were in the Colorado Rockies, nearly 2 miles above sea level. The temperature was about 20 degrees, and around us the snow lay about a foot deep. Night was coming on, and with it subzero cold. We had no compass, no matches, no sleeping bags, no tents. We had only a few stale sandwiches and a candy bar or two among us. We had only the vaguest idea of our whereabouts.

The idea for this survival trip was mine. The Hunter Safety Coordinator for the Department suggested that I prepare a survival course for the State program for junior hunters. In our discussion, we discovered that for every hunter who is shot, the Game and Fish Department gets about 100 calls to help find a lost hunter.

Perish or Survive

So we set out to learn what it takes to survive in the mountains. Six of us spent 3 days and 2 nights on Mt. Evans in March 1969. Snowmobiles dropped us off in a blinding snowstorm. All we had to do was stay put and survive; the snowmobiles would return 3 days later to pick us up.

Our first job was to find shelter. With our hunting knives, we dug a snow cave in a snowbank large enough for all six of us to sleep on a mattress of pine boughs. It was 15 below zero outside that night. In our snow cave, it was 32 above.

The moderate exercise we did was fine, but it would not be adequate to simulate a man lost under actual conditions. We had no food, water, or cooking utensils. We had only a small survival kit with a few small tools. But the most important fact was we *knew* the snowmobiles would be back for us, and all we had to do was stay as comfortable as possible until then.

The other fellows on this exercise came from all walks of life. There was a plumber, a computer programmer, an airline pilot, and two teachers. Later, we analyzed what we had learned. After realizing we had learned little, I started thinking about another exercise that would more nearly simulate the conditions that would confront lost hunters.

The Second Trip

At a meeting of the Western States Hunter Safety Coordinators in Pinedale, Wyo., I was asked to prepare a survival manual for use by game and fish departments throughout this region. From that request I received authorization for a second exercise.

I was thinking of a solo outing, but too many people thought it was a good idea and wanted to go along. About 30 or 40 people asked to go, including some women who argued that women go on hunting trips and get lost, too. I had a tough time telling them "No."

Finally, I selected Harry Kissell and Jack Wilhite because they had made the first trip with

Above, seven of the team strike out across the snowy wastes on the first morning of their survival exercise. Below, Errol King flashes a smile of success as he pulls a native trout from an ice hole. Right, below-freezing temperature forced Jack Wilhite to warm his feet over a campfire during a break.

me. Harry is a Denver school teacher and also an instructor with "Outward Bound," an international school which teaches young people to survive under the most extreme conditions. Jack is an airline pilot and a lieutenant-colonel in the Colorado Air National Guard. Two men from the Wyoming Game and Fish Department enthusiastically volunteered to go—Dick Keeney, Director of Education, and Joe Vogler, Public Information Officer. Dale Gaskill, Director of Training for the National Rifle Association in Washington, D.C., also joined us.

We received two late additions when the news media heard about our plans. The Associated Press sent along Hunter Holloway, and United Press International sent Errol King. The ages ranged from King, the youngest at 30, to me, at 44.

Didn't Know Where We Were

We had only two meetings before starting the trip. Jack Wilhite arranged for an Army helicopter from the Medical Evacuation Service to drop us off in the mountains. The rules were pretty strict. The helicopter pilot wouldn't tell anyone where he would put us down. And we didn't find out. All we knew was we were somewhere north of Rocky Mountain National Park, in the north-central Colorado Rockies. We went dressed only as the average hunter might be, with warm clothing, a hunting knife, a sidearm, and perhaps a sandwich in our pocket. Nothing more.

We arranged with the Colorado Game, Fish, and Parks Department to send up a search airplane 24 hours after the start of the exercise to look for us. The pilot would be told only in the most general terms where we were believed to be. If he spotted us, he would drop a package containing some survival gear.

Our only real concern was the weather. If a good snowstorm moved in, or if someone got sick or was injured, we would stick with our plans. These are the hazards that might occur in an actual emergency, so we were determined not to make it easy on ourselves.

The chopper made four round-trips to bring in our group of 8, leaving us at the 11,000-foot level near a frozen lake. We hadn't seen any roads, buildings, or other signs of habitation during the approach to our landing site. So when the beat of the helicopter vanished, and we took stock of our surroundings, we knew we were really lost.

The last pair of men in our group hadn't landed until nearly dark, so we remained at the frozen lake the first night. We spent that night trying to get some sleep, but without much success. The chill factor put the temperature well below zero; one of the men huddled so near the fire he burned his parka.

A Meal of Pine Squirrel

There was little for breakfast. A couple of our group managed to shoot a magpie and a pine squirrel, which we dressed and roasted. There wasn't much to eat. Each man got about one pinch of meat, and the taste was pretty bad.

We heard the sound of an airplane about mid-morning and signalled it with a mirror. It was the Game and Fish plane. After spotting us it swooped low, and dropped the survival package on the nearby frozen lake.

Most of the package contents were smashed: compasses, pen lights, liquid fuel for the little camp stove we had hoped to use, and even some "tropical chocolate" bars which were so brittle from the cold they shattered into thousands of tiny slivers.

It was quite a disappointment, but we salvaged as much as we could, including drinking cups, snare wire, wire saws, 2-ounce survival blankets (a foil-like material that reflects body heat), metal matches, and steel wool. A metal match is a nail-size device which produces a spark. Steel wool, lit by a spark from a metal match, started our fires.

We headed in a northerly direction, following the drainage downslope toward what we hoped would take us to the Cache la Poudre River, which heads up near the Continental Divide and flows eastward. Our progress wasn't encouraging. We tried to set a steady pace, but the terrain was very tough and we were unsuccessful.

The Danger of Hypothermia

We didn't have much humor or desire for conversation after the first day. We perspired tremendously from exertion and the altitude, and we consumed enormous amounts of water to avoid dehydration—one of the great perils that confront someone lost in the mountains. It is important to *avoid* eating snow. It provides very little water, yet gives the psychological impression of having

quenched one's thirst. Consequently, a person can become dehydrated and get hypothermia without being aware of it.

Hypothermia is a condition in which the internal body temperature is lowered and the victim becomes clumsy, thick of speech, and sort of euphoric (an often unaccountable feeling of well-being or elation). It can kill so quickly that it is frightening.

We shot another pine squirrel on the second day, and supplemented it by eating a few juniper berries, the inner bark of the aspen tree, and some parasitic moss. None of which was very appetizing, but it was better than the batch of sage tea we brewed.

The third day, we stopped at frozen beaver ponds and chopped a hole through the ice. It was about 8 inches thick. Using a hook and a piece of foil, one of the fellows managed to catch a native trout. We used part of the entrails as bait to catch three others. None was more than 12 inches long, but they tasted fine.

Tremendous Exertion

Some of us were getting in rough shape by the third day. The exertion of moving through heavy downed timber or up and down steep, rocky slopes is unbelievable. Two of us had fallen and picked up some painful bruises. Another cut his hand, and one of the reporters had a 2-inch scalp cut inflicted by a broken branch.

Snow wasn't a problem; there hadn't been a major storm for some time, and generally it was no more than a foot deep. But toward the latter part of the exercise, hunger and exhaustion made us irritable.

On what proved to be the last (third) night out, I had the team split up to prepare individual shelters over a widely separated area. I wanted them to feel completely alone. Previously, we had paired off in our sleeping lean-tos, sleeping at a single campsite and using a common fire.

Each morning, we dismantled our shelters and discarded the branches over a wide area. We took pains to leave absolutely no trace of our passing. The absence of all signs of human trespass, incidentally, was one of the real pleasures of our journey. It was a totally clean and natural environment—beautiful.

We had been hiking down a very steep incline for about an hour on the fourth morning when we heard the sound of vehicles in the distance. The reaction? It was one of elation, pure and simple.

The Lost Aren't Lost

We reached a frozen river that some of us recognized as the Cache la Poudre, and just beyond was the highway. As we came packing out of the thicket, a motorist caught sight of us, rolled down his window, and called: "Are you guys *lost?*"

"Not any more!" one of our group responded.

We had walked only about 10 miles, taking 4 days to cover that distance, but it was some of the most rugged country imaginable. I believe it would have been impossible to follow our route in reverse: the path *up* would be incredibly steep and hazardous.

What did we learn? A great deal.

We learned, first, the average man can endure more than he thinks when he's lost in the wilderness. Second, we gained a new appreciation of the need to remain calm and to avoid panic. Third, the value of water became vitally important: it's easy to dehydrate in a remarkably short time. Food is less important than one might think. Eight of us survived for 4 days and 3 nights on 4 trout, 2 pine squirrels, and a magpie, and I lost only 8 pounds. (My normal weight is 210.)

Fourth, anyone lost during harsh weather should make a special effort, particularly at night, to get out of the elements. It's important to get under cover, whether it be a lean-to, a rock crevice, or a snow cave, to escape the wind, rain, or snow, and to conserve as much body heat as possible.

Finally, anyone going into unfamiliar territory should take along some basic equipment such as a signal mirror, matches in a waterproof container, a plastic whistle, and something in which to melt snow, for example, no matter how briefly he expects to be gone.

Why a plastic whistle? It's far superior to a gun for signalling, and plastic won't freeze to your lips as metal will in extreme cold.

Most importantly, perhaps, is the fact that hunters and hikers should always leave word with a friend or neighbor apprising where they are going and when they expect to return. There are legitimate reasons for getting lost. There are no excuses for staying lost. There is no need to die in the wilderness. # # #

ANGOSTURA Reservoir, in southwestern South Dakota near the southern part of the Black Hills, has proved to be an excellent water recreation area since its formation. It was created upon completion of Angostura Dam in 1950 by the Bureau of Reclamation. The dam is on the Cheyenne River near Hot Springs, S. Dak.

Recreation at Angostura

Even though conservation space in the reservoir is used primarily for storage of irrigation water, recreational activities, such as boating, fishing, water skiing, camping, and swimming, have been greatly enhanced.

A water surface of 4,700 acres and the surrounding 4,546 acres are available for recreation. Recreational use in 1970 totaled 100,000 visitor days. About 70 percent of the recreation visits consisted of people residing within approximately 1-hour driving time over hard-surfaced roads. Most of the remainder were out-of-state vacationists, including campers coming to the Black Hills area.

Shortly after the first impoundment of water in 1949, the South Dakota Department of Game, Fish and Parks eradicated trash fish species (carp and suckers) from the reservoir preparatory to stocking it in 1950 with desirable species such as pike, bass, bluegill, and perch. The reservoir area was reopened to fishing on July 1, 1952. Fishing has been "good" to "excellent" except for two years during which there was substantial drawdown of reservoir water because of low inflows. The State Department of Game, Fish and Parks is continuing its fisheries management of the reservoir.

Recreational development and management have been carried out pursuant to plans developed by the National Park Service, the South Dakota Department of Game, Fish and Parks, and the Bureau of Reclamation.

A Memorandum of Understanding between the Bureau and the South Dakota Department of Game, Fish and Parks became effective on January 1, 1959, and provided for State administration and development of the reservoir for wildlife and recreation purposes. Prior to then, and since the reservoir became operational, the Bureau arranged for 8 wildlife habitat development areas and then so-called "minimum basic facilities" to accommodate immediate recreation needs.

The State has demonstrated recreational management capability although inadequate funds during the early years caused some delays. The availability of cost-sharing moneys under the Land and Water Conservation Fund Act of 1965 (administered by the Bureau of Outdoor Recreation)

has financed facilities, including access roads. Further improvements are planned and will be provided as additional funds become available.

Leased for Grazing

The reservoir was not surveyed until 1963 and administration of the lands was not easily managed prior to field identification of the property lines. Most lands without recreation facilities were leased for grazing. The Bureau is cooperating with the State in the installation of a fence on the boundary. This facilitates the management of the reservoir lands, including the control of livestock grazing. The State has long-range plans for curtailment of grazing and subsequent utilization of most of the land area within the reservoir boundary for recreation and wildlife use and development. Control of grazing has contributed to restoration of desirable vegetative growth on much of the reservoir area lands and thus has decreased the vulnerability of the soils to wind and water erosion.

A critical factor in management of the reservoir area for public recreation is the cost of providing all of the camp and area maintenance or policing forces needed to serve visitors. Where user fees are

Facilities for fishing, camping, boating and picnicking are plentiful at Angostura. ***Photos courtesy South Dakota Department of Game, Fish and Parks***

insufficient to cover a major share of these expensive services, a source of cost-sharing funds is needed. The South Dakota Department of Game, Fish, and Parks is confronted with this need in the management of Angostura, as are other agencies elsewhere.

The State plans to institute entrance and campground fees in 1972. Charges will be consistent with areas that have similar facilities. The expected annual recreation visitations to Angostura Reservoir are estimated to be 150,000 by 1975, over 200,000 by 1980, and should approach 300,000 by 1985, if adequate facilities are available. # # #

WATER Quiz

1. Water comprises what percentage of the human body?
   a. 96
   b. 79
   c. 89

2. Pure water contains:
   a. hydrogen and oxygen plus 33 different forms of hydrogen and oxygen
   b. hydrogen and oxygen only
   c. 75% hydrogen and 25% oxygen

3. The Bureau of Reclamation now has recreation areas on ____ projects.
   a. 115
   b. 297
   c. 242

4. A *khanat* is:
   a. a method of water management
   b. another name for subsurface drainage
   c. a subterranean shaft which intercepts the water table underground

5. Boating is a common form of recreation on nearly all Bureau projects. One of the most unusual forms of boating is kayaking. In the conservancy district of which Bureau project are kayak races held annually, attracting competitors from all over the world?
   a. Colorado-Big Thompson
   b. Fryingpan-Arkansas
   c. Buffalo Rapids

Answers On Inside Back Cover.

by **JOSEPH B. MARCOTTE, Jr., Chief of Water and Land Operations Division, Fryingpan-Arkansas project (former Repayment Specialist, Sacramento Valley.)**

THERE'S a leak in the irrigation system on the Vint Symons, Jr. farm in the Red Bank area west of Red Bluff, Calif. In fact, there are several "leaks," but no one seems excited because it was planned. The "leaks" are through specially constructed devices called drippers and the purpose is for irrigation.

What's happening? It's called "drip" or "trickle" irrigation.

In keeping with the American tradition, the Tehama County Farm Advisor's office, in cooperation with Mr. Symons, is seeking a better way to "do its thing." While drip irrigation is fairly new to American agriculture, it is not new to the world. It was developed in Israel* and has been used extensively in some other countries.

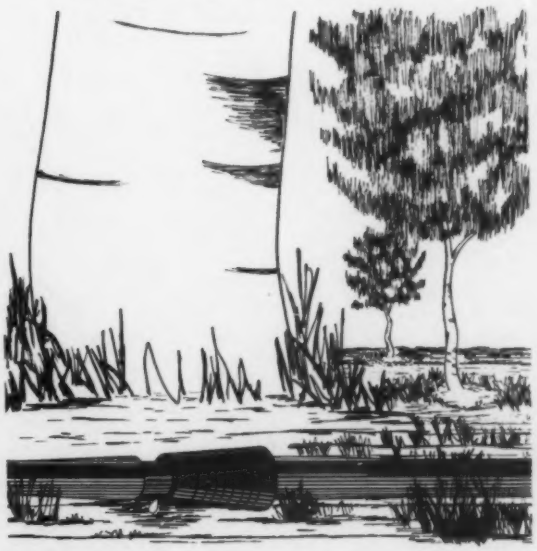
The process is simple. Under normal irrigation practices such as flood, row, or sprinkler irrigation, water is applied periodically when the farmer decides it is necessary to meet the needs of his plants. Under drip irrigation, water is applied continuously, ideally at a rate which neither starves nor drowns the plant.

Experience has shown that drip irrigation can offer numerous benefits and in some cases permits irrigation where no other way is practical. Water can be used for production of crops only, rather than lost to weeds or non-crop areas. Water normally considered too saline for irrigation can sometimes be used. Weed control and irrigation labor costs are lowered. Plant stresses caused by too much or too little water are drastically reduced.

Conventional methods of irrigation depend upon periodic replacement of the available water supply in the soil. Unless extreme caution is used in the process, irrigators may apply too much water at the time of irrigation and then as the plant uses water, the root zone may become too dry before more water is applied. Both conditions impose a shock upon the plant's system, keeping

*See November 1970 issue of *Reclamation Era* pages 15–16 for additional information concerning the development of drip irrigation in Israel.

Artist's concept of drip irrigation on young walnut trees.



the plant from performing at peak efficiency throughout the growing season.

Once a drip system is properly regulated, plants never suffer from too much or too little water. By adding water-soluable fertilizers, water and plant food are always available in the quantities needed for optimum production. Dramatic increases in crop yield have been recorded when drip irrigation is used compared to other methods.

One additional benefit is the amount of water saved. When using conventional irrigation, it is practically impossible to apply exactly the right amount of water needed for plant growth. In attempts to apply exactly the amount of water needed for plant growth, irrigators often apply more water than the soil can absorb or retain, resulting in losses through deep percolation and surface runoff. By applying water in quantities only sufficient to meet plant needs, deep percolation and surface runoff are eliminated, resulting in significant savings.

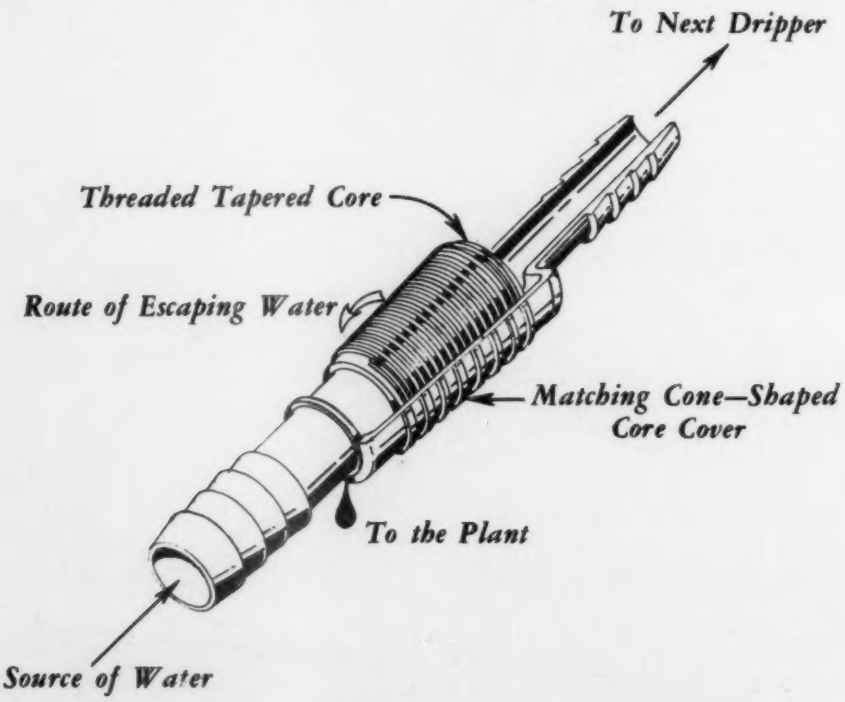
Many areas of the Sacramento Valley have a soil known as Tehama Loam, a very tight silt-clay mixture. Mr. Symons has planted a grove of walnuts on this type of soil. Tehama Loam presents almost insurmountable problems for irrigators. The infiltration rate is very slow, making it almost impossible to get good penetration of water applied conventionally at the surface.

The Farm Advisor's office and Mr. Symons hope to demonstrate that, with drip irrigation, water can be applied at less than the infiltration rate and in sufficient quantities to sustain the plant in a state of optimum water availability.

The demonstration plot consists of 22 walnut trees in their third year after grafting. Water is supplied from wells. The distribution system is made up of ½-inch polyethylene tubing with three drippers (technically known as emitters) at each tree. As the trees grow larger, they will require more drippers to a planned six per tree. Drippers vary in size and design as well as price, which ranges from 20 cents to more than $1.

The polyethylene drippers being used are of an extremely simple design consisting of a threaded tapered core covered by a matching truncated core. Water escapes from the system along the threads of the core which control the release rate by the friction along the thread itself. Total costs of installed drip irrigation systems range from $300 to $700 per acre.

While some drip irrigation systems operate at



This cross section illustrates the dripper (emitter).

Drip system components. Note size compared to walnuts.

pressures as high as 20 pounds per square inch, the operating pressure on this system is approximately 5 pounds per square inch. In regulating the system, it was discovered, however, that over-irrigation is possible with the drip system—two trees were drowned.

The system has been in use for only one season and is installed on top of the ground. The total weed growth has been reduced, although in the vicinity of the drippers, weed growth is prolific. With the system installed on top of the ground, the normal practice of mowing the weeds would also destroy the system. Caution is necessary in the use of herbicides, since they may damage the plastic pipe and drippers.

Burying the entire system was considered. This should facilitate cultural maintenance of the orchard. However, a number of problems cropped up. Since the infiltration rate of the soil is extremely slow, a large interface of water to soil must be provided; caution must be exercised to prevent roots from entering the dripper; and there is a risk of crushing the dripper with tractor-type equipment during cultural operations.

Experiments were conducted to determine configuration of the burial of the dripper. The best method found to date is to bury the dripper in a gravel-filled hole of adequate depth. An underlying clay stratum in the demonstration area causes the infiltration rate to be so slow that a practical hole size could not be found.

Due to the unresolved problem with weeds, the Farm Advisor is considering relocation of the experiment. A new site will be selected in the Tehama Loam type soil, but without the clay "barrier" so near the surface, making burial a possibility. The present thinking is to locate on olive trees, possibly in the Corning Water District.

After one irrigation season, trees irrigated with the drip system appear to have fared as well as adjacent trees irrigated with sprinklers. Although some problems remain to be solved, agriculturists are optimistic about the future of "drip" irrigation in Tehama County.

Should the drip system prove to be a viable means of irrigating high-value crops on tight soils, a dramatic solution to an old and serious problem will have been found.

# # #

THE THIRD POWERPLANT
. . .*Its Impact on People*

by SAMUEL S. REY, Administrative Officer
Third Powerplant Construction Office

THE Grand Coulee Dam area grew out of construction activities funded by a total Federal investment of $761 million which began in 1933. By 1951 Federal investment resulted in the completion of Grand Coulee Dam, two powerplants, a pumping plant, and the initial water distribution system. The distribution system with six more units in the pumping plant, will eventually supply the 1,000,000+ acreage potential of the Columbia Basin project.

The Community

Over this period of time, thousands of people were employed. But after what was believed to be final construction, the area settled down for a number of years into a comparatively calm urban community.

The "community" was a loosely grouped, but highly independent cluster of people. It consisted of four cities: Coulee Dam, established at the foot of the dam in about 1934 when construction first started; Grand Coulee, above the dam just upstream from the left abutment; Electric City, to the west and now on the shore of Banks Lake; and Elmer City, 6 miles downstream from the dam.

Little did the residents realize they were destined again to experience not only the rumble and excitement of heavy construction, but also dozens of major problems that would accompany the Third Powerplant program.

Increased Power Capacity

It would have been difficult to realize then that this unprecedented construction effort would greatly increase existing power capacity. Expansion of the power facilities became possible through an international water treaty ratified by the United States in 1961, by Canada in 1963, and finally effected in 1964.

Looking southwest from the dam, one can see Grand Coulee and Electric City.

The Third Powerplant program, authorized by Congress in 1966, together with up-rating of existing generating units, will increase existing power capacity from 1,974 megawatts (mw) to 5,880 mw with initial installation of six 600-mw units. The Grand Coulee power complex may ultimately be increased to 9,780 mw by expanding the plant by installation of an additional 6 units, yet to be authorized, and installation of 6 reversible pump-generating units. Culminating in the 1990's as the world's largest power-producing complex, this program will entail over $400 million for the first 6 units and will be keynoted by hydropower generating units never before developed at a capacity of 600 mw.

The impact of these developments began to take focus in a preliminary task force report issued by the Bureau of Reclamation in July 1966. The report identified such problem areas as community relations, beautification and community planning, visitor programs, highway coordination, air transportation, housing and land acquisition, and coordination of construction activities with existing power operations.

The Impact

As the magnitude of the project became more apparent, the local people began to realize that the real impact they would experience would be "program-caused" but "people-related." "People-related" impacts include the space people occupy, the payroll dollars they earn and spend, the business and community services they demand, and

the apprehension concerning the effect this construction was to have on their social and economic base and structure.

One unusual aspect of the Third Powerplant program, in addition to its mind-staggering size and complexity, came through loud and clear—*the project would be built in and around the very heart of settled communities.* This would be quite different from the well-planned communities which the Government constructs when it builds in isolated locations.

One of the first "program-related" matters affecting the Grand Coulee Dam area was a determination in 1967 by the Bureau of Reclamation. This determination dealt with the amount and location of land needed to construct not only the authorized 6-unit plant, but also sufficient land to accommodate the long-range 12-unit program to avoid disrupting again the commercial and residential areas of the city of Coulee Dam.

This was a period of apprehension. Acquiring the needed land seemed impossible when it was realized that about 25 percent of the city of Coulee Dam would be converted to the Third Powerplant facility. This meant 54 residences, 8 businesses, the Government-owned visitors center and some city-owned community facilities would have to be purchased, relocated, or destroyed.

Relocation Was Successful

Through meetings and finally by professional appraisal and negotiation, the necessary properties were acquired in less than 12 months. A satisfactory arrangement which permitted reduced purchase prices provided for relocation of homes and buildings. All but one residence was relocated—mostly to other city lots in Coulee Dam.

A theater and bowling alley were provided, along with restaurant facilities and a fire hall in a new city-owned complex (six of eight of the commercial properties opted for salvage). Extensive public relations efforts began during 1967 to show hundreds of interested people, potential investors, suppliers, service groups, chambers of commerce, etc., the impact this construction had and is now having.

One comparison used involved employment at the recently completed Glen Canyon Dam. Employment was about 2,400 in 1971 and 1972, with peak annual payrolls exceeding $30 million. This contrasts with pre-Third Powerplant Bureau operation and maintenance payrolls of about $2,300,000 annually.

Above, the "bust" that followed the "boom" came in the form of many abandoned and deteriorating buildings which are now being cleaned up. Below, the old city-owned bowling alley in Coulee Dam is being razed to provide working area for contractor operations.

Problems of More People

But the local area also began to feel the "people-related" impact when the Third Powerplant staff began transferring to the city—all looking for a place to live.

Reminiscent of earlier construction days, business areas became crowded, traffic caused consternation among the "natives," and an unoccupied place to live was a rare commodity indeed! And what everyone really wanted to know was, "How many people will be here during the various stages of construction." Earlier task force studies were

used. These showed future programs and through a detailed study of the types and magnitude of construction to be involved, updated employment data were revealed.

These projected employment levels proved generally to be accurate. As a relative measurement, total program accomplishment through fiscal year 1971 amounted to about $141 million (or about one-third complete). A balance of about $292 million remains within the authorized 6-unit program extending to nearly 1980 (the first three units are to go "on the line" in 1974 and 1975; the second three, originally scheduled for 1979 and 1980, are being expedited).

Above, a familiar sight in Coulee Dam was the 49 homes en route to their new locations. Below, with a mighty crash, the "headache-ball" struck the Bureau's tour center to make way for the Third Powerplant construction activities.

Prices Increase

One byproduct of the "people-related" impact, in response to the ever-growing local demand, was the rapid inflation of prices in real properties, as well as in goods and services. Many retired people who had found satisfaction in the quiet pre-Third Powerplant communities, the comparatively mild, dry climate, and the pleasure of the uncrowded north central Washington outdoor recreation, did not want to cope with the new hustle and bustle.

Many took advantage of the gain in property values, sold their homes to incoming workers, and relocated. Other extensive effort was made, however, to provide living accommodations, and during the first 4½ years, residential property growth was significant. There were no rentals except of older and inadequate buildings. New privately owned homes were individually constructed, as shown in the following table:

	Elmer City	*Coulee Dam*	*Grand Coulee*	*Electric City*
Homes relocated from "take-area"	5	43	—	1
New homes constructed	6	52	9	66

Even this growth was inadequate and several investors soon moved in to fill the gap. Spaces were developed for mobile homes and trailers to accommodate the vast majority of Third Powerplant workers. The result was an increase from about 340 spaces in 1968 to 1,207 in 1971 (a growth of nearly 400 percent), with proposed developments for additions expected to provide 1,500 spaces during peak construction years. Many trailer spaces and mobile home lots were established on private lots, but developments were principally in consolidated courts scattered throughout the area.

Another benefit was the razing of old tumbledown structures unoccupied since the boom days of Grand Coulee Dam construction.

Environmental Improvements

Such cleanup throughout the area has provided many good sites for new homes and has achieved some real down-to-earth environmental improvement. Solving the main housing requirement by providing trailer space dovetailed with the living habits of a majority of incoming construction workers. Many are skilled craftsmen and artisans

who move their families and trailers to distant areas as demanded by heavy industrial construction programs. Subsequent studies of the work force during 1970 supported this fact and further revealed that the construction work force, while extremely mobile, lives as close as possible to the jobsite.

About 20 percent of the work force was "local," living in or near the Grand Coulee Dam area prior to Third Powerplant construction. The remaining 80 percent moved in with the job. Moreover, of those who were not "local," 74 percent resided in the Grand Coulee Dam area while 26 percent commuted in, generally from within 50 miles. Thus, outlying communities within this radius experienced some measure of "people-related" impact, but to a much lesser degree and with almost none of the social and economic problems of the immediate Grand Coulee Dam area.

The Third Powerplant construction staff is comprised largely of college-trained professionals, and technical and business management employees who administer the program and provide technical review, supervision and surveillance of the hundreds of facets involved in this complex and fast-moving activity.

While stopgap trailer-type housing was leased by the Bureau to accommodate the staff and as an inducement in recruitment, this type of housing has basically become absorbed into the permanent community with 70 percent owning their homes and 30 percent renting private or Government-leased trailers.

Also benefitting the community is a large number of "Bureau-wives" who are active in nursing, teaching, and business. This settling-in process is in direct response to the dynamic impact of the Third Powerplant program.

While many workers will eventually go to other jobs and most are already veterans of many previous relocations from projects throughout the West, a significant number anticipate concluding their Bureau careers on this project. The huge and complex Third Powerplant program required selection of the best Bureau talent available, and the communities benefit from this as these people become involved in community affairs as concerned citizens.

School Facilities

It seemed, as housing problems were being resolved, that the major impact worry was over. But as families moved in they brought school-aged children in such numbers that local school facilities and teacher availability were overtaxed. The two school districts involved faced imminent funding problems. The student growth experienced by these districts in grades 1–12 is tabulated below:

Date	Grand Coulee District	Coulee Dam District	Four other small districts within 30 miles of Grand Coulee Dam	Total
Sept. 1966	407	623	796	1,826
Dec. 1967	495	712	929	2,136
Sept. 1968	650	737	939	2,326
Sept. 1969	590	736	945	2,271
Sept. 1970	617	802	972	2,391
May 1971	709	831	984	2,524
Sept. 1971	[1] 1,616		1,026	2,642

[1] Grand Coulee Dam District consolidated.

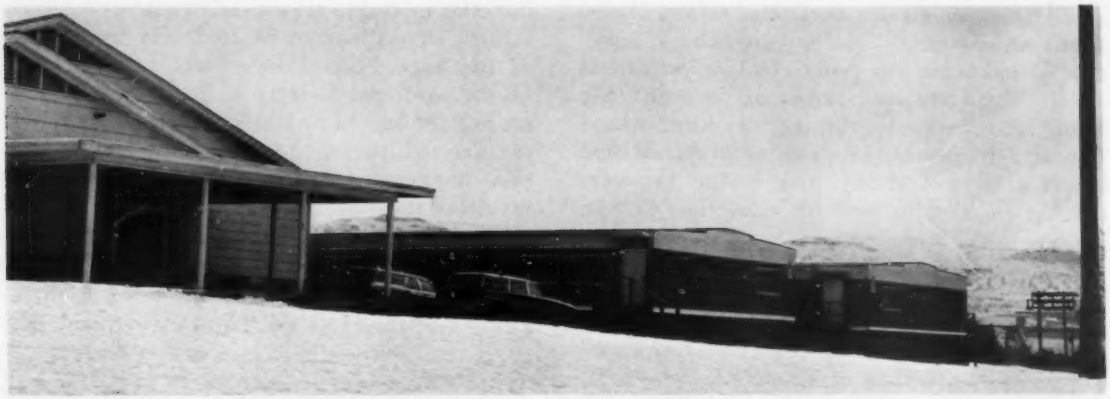
Desperately, the districts sought Federal and State funding for current operations and for expansion. As an interim measure, both districts acquired several portable classrooms on a lease-purchase basis. Federal funding under P.L. 815 for new facility construction, as well as P.L. 874 for operation and maintenance of school systems, was badly needed but not available. Nor was it possible under the laws authorizing Reclamation projects to provide direct funding or assistance through Third Powerplant appropriations.

Ultimately, it was incumbent on local taxpayers to provide special property tax levies to meet the ever-increasing education needs, although limited relief was eventually received under P.L. 874.

An Old Rivalry

In coping with these problems, it became apparent that an old sectional rivalry, carried over from early construction days still existed. The *Coulee Dam School District*, which encompassed the towns of Coulee Dam and Elmer City, lies downstream of the dam in remote corners of Okanogan and Douglas Counties. The *Grand Coulee School District*, upstream of the dam, was similarly situated in remote corners of Grant, Lincoln, and Douglas Counties.

The town of Coulee Dam was developed during construction of the dam as an "engineer's town" and to some extent as a contractor's camp. Over the years the town had become established as a Federally-owned town, a well-engineered and fully



Relocatable classrooms accommodate the influx of students. Ten of these structures which each seat 60 students are currently in use.

maintained community. In the late 1950's, Federal control was relinquished, the town was incorporated under State law and the residents acquired homes and community properties.

On the other hand, the towns of Grand Coulee and Electric City had early origins through a boom-town approach with little planning. The only resources were derived from the residents themselves. During the same period that Federal control of Coulee Dam was relinquished, some aid was acquired for community facilities associated with Federally owned land in and around the town of Grand Coulee.

Intercommunity rivalry was most broadly manifested as it became apparent that State and Federal financial aid would be made available only when the two school districts consolidated to achieve more effective and coordinated educational management and effort. Those in opposition apparently feared a loss of individual high school identity and that a consolidated high school would not be located in their community.

School District Consolidation

Largely through the efforts of citizen groups which included many "newcomers" (with an assist by the local press), a vote was taken on this closely contested issue. The decision was that a full consolidation would become effective for the 1971–72 school year. The extensive effort necessary to achieve this was highlighted by a professional study made through the University of Washington which fully endorsed the principle and execution of a school consolidation. It also broadly examined the potential for junior college level study that could expand and develop in the community.

The consolidated school district is now proceeding with plans and actions to construct a new high school facility. With good local support, it is again utilizing a citizens' committee for policy guidance and execution of various phases of the overall educational plans for the Grand Coulee Dam area. The preferred site for this facility, between Grand Coulee and Electric City, is centrally located in the area where 75 percent of the high school population resides.

The long-range program, integrally geared to the overall Third Powerplant program, recognizes peak impacts during 1972 and 1973 and realistically plans for maintenance of a school population that will never return to pre-Third Powerplant levels. The program particularly looks to the quality of education and the repeat impacts to be experienced during construction of the second 6-unit development of the Third Powerplant. "Program-caused" and "people-related" impacts were and are a very dynamic consideration in the local educational area.

The task force study made during early years of the construction program also brought a realization of the need to explore and plan for the social and environmental impacts directly and indirectly related to the long-range Third Powerplant program.

In 1968, the Spokane, Wash., firm of Kenneth Brooks, Architectural Consultant, completed a study of the area's industrial, social and economic conditions, capabilities, and potentials.

Environmental recommendations which were developed included a 10-stop visitors' grand-tour of power facilities and the immediate area; a new arrival center; a chain of lakes; portage canal and

wildlife refuge, all downstream of Grand Coulee Dam; an extensive lighting program; a campground and swimming pool to replace facilities at Elmer City; a jet airport; and a non-jet strip along Banks Lake, soon to begin construction under local Port District sponsorship; scenic and recreational improvements; highway and bridge improvements; and development of industries, schools, housing and towns.

An environmental advisory council including leadership from all levels of State and local business and government, was formed to consider Mr. Brooks' recommendations. These recommendations serve a variety of interests as a thought-provoking guide. They point out the potential greatness of the area and the environmental decisions that should be considered as growth and expansion continue.

Concurrently, an area-wide Conference of Governments was formed to provide coordinated planning and review in such areas as water and sewage, transportation, education, law enforcement, etc. Such an organization was required to assure even cursory consideration for Federal and State assistance in funding. As this organization developed, its scope of interest has greatly widened.

A local coordinated group is emerging to weigh and consider a multitude of common and related community and area plans and actions. This group will not only deal with "people-impacts" at its level, but will encourage the translation of these plans into reality. The infusion of change and new people into the Grand Coulee Dam area, and the dynamic functioning of citizens' groups and environmental and planning bodies is providing local direction needed to aid the community as it grows.

Such efforts tend to be hidden in the shadow of the huge Federal investment in the Grand Coulee area, particularly as total local tax resources are limited by that very fact—i.e., there is taxation on private properties, businesses, and sales, but none on the Federal plant that sired and nourished these communities.

Impact on Business

On the other hand, local businesses have received the impact of the Third Powerplant program as a welcome gain over earlier business activity. The growth (25 percent in establishments and 44 percent in employment) in this "support" activity is shown in the following table:

Category	Commercial establishments		Nonbureau employment	
	1967	10/71	1967	10/71
Retail stores	44	39	144	181
Professional and personal service	11	25	31	60
Hotels-motels-trailer parks	12	21	21	42
Automotive and petroleum	19	28	56	79
Restaurants	12	14	64	99
Banks	2	2	12	16
Insurance agencies	7	4	12	7
Local contractors	15	7	29	33
Local and State governments	9	12	89	101
Lumber mill	1	1	44	44
School districts	2	1	97	145
Hospital	1	1	0	37
Miscellaneous	25	51	56	104
Total	167	206	655	948

This motel was constructed to replace an old one destroyed during the construction of the dam. Each of the modern 47-units has a balcony view of Grand Coulee Dam.

With a style which suggests kinship to Grand Coulee Dam, this concrete facility provides a fire hall, restaurant, bowling alley and theater for area residents.

Expansion and construction of business and recreational facilities indicate the favorable reaction of local businessmen. It shows their desire to provide the goods and services demanded by the "people-impact." Also, local suppliers have effectively serviced on-site contractors for many of their day-to-day supply requirements and specialty services.

During 1972 and 1973 as construction continues on the Third Powerplant and Forebay Dam, on-site fabrication and installation of huge turbines and generators will continue and additional contracts will be awarded for switchyard and powerplant completion. During the same period, two additional pump-generators will be installed in the Grand Coulee Pumping Plant.

With the authorized 6-unit program now about one-third completed, peak employment is still to be achieved. Present employment levels of about 1,500 in contractor's forces are expected to expand to about 2,100 with the increase residing in the Grand Coulee Dam area. While new "people-related" impact problems are not expected, the degree of impact will certainly be heightened beyond what the area has experienced to date.

Installation schedules being expedited on the second group of three power units will cause employment levels to remain higher than anticipated in the late 1970's. When authorized by Congress, the extension of the Third Powerplant and installation of six additional power units will make the 1980's a replay of the first decade for high construction employment and "people-related" impacts.

Other vital programs for recreational development and the possibility of a High Voltage Test and Research Center being established here are dynamic forces that will bring new impacts and an impetus to further weld the Grand Coulee Dam area into a cohesive structure. The experience gained over many years of growth and construction should well serve area residents as they live through the still exciting periods ahead. # # #

FIFTY YEARS AGO
in Our Magazine

RECLAMATION RECORD 1922

Minidoka Project, Idaho

THIS project, located in southern Idaho, is a good example of the substantial returns of irrigation development. In 1904 it was an uninhabited sage brush desert, no towns, no farms, no railroads, no facilities of any kind. All that it is to-day is the result of the construction of irrigation works by the United States Reclamation Service. The cost of reclaiming the present irrigated [irrigable] area of 121,000 acres has been $5,800,000. Of this amount $1,600,000 has been repaid.

The project includes several large undertakings outside the present irrigated area. The Jackson Lake Reservoir supplies water to 630,000 acres besides the land for which the Government has built the canals. The American Falls Reservoir, when completed, will furnish water to safeguard the crops on 900,000 acres that are now in cultivation and a complete water supply for 450,000 acres of new land most of which will probably be available for homestead entry.

A proposed extension adjoining the present irrigated area on the north and west contains 115,000 acres of public land. The net construction cost of the entire project has been $7,200,000, of which $2,600,000 has been repaid.

Milk River Project, Montana

PROJECT Manager Stratton . . . comments as follows on the reports of dryfarmed and irrigated crops . . . The lower crop value per acre as a whole on irrigated land as compared with that of dryland crops is due in large part to the fact that about 50 percent of the irrigated area is in native hay and only about 30 percent of the dry area is in that crop . . .

In regard to alfalfa, the price was so low that some of the farmers did not cut their fields, or cut only once. This applies to a greater extent on the irrigated than on the dry lands . . . . Alfalfa was also damaged to some extent by heavy rains in June just after having been irrigated. Or to put it another way, irrigation was a damage to alfalfa crops in these cases.

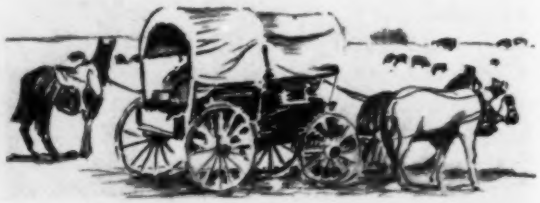
In regard to barley, there were only 10 acres on the irrigated area and 14 acres on the dry farmed . . . .

For beans the records are for 1 acre irrigated and 3 acres dry farmed . . . .

In regard to wheat and flax the irrigation was in some cases applied after the weather had become hot, so that the grain was scalded . . . .

(Explanation of low production was:)

1. Lack of skill or care on the part of the irrigator.
2. June irrigation followed by heavy rain.
3. The best dry-land crop reports were those that occurred on sandy loam in sheltered spots along the river; these crops tended to increase the average production on dry farms.
4. In nearly every case crops grown on dry farms were produced on ground that had been previously irrigated and cultivated, thereby gaining considerable advantage over quite a number of the irrigated wheat crops which were produced on first-year land.



today...

Minidoka Project 1972

THE Minidoka project now furnishes a full or supplemental water supply to more than 1 million acres of land from 6 reservoirs having a combined active storage capacity of 2,784,600 acre-feet.

This water, stored and used and restored and reused on land that was formerly a barren sagebrush flat, makes possible homes and a livelihood for thousands of people today.

The project works consist of the Minidoka Dam, Reservoir, and hydroelectric powerplant; Jackson Lake Dam and Reservoir; American Falls Dam and Reservoir; Island Park Dam and Reservoir; Grassy Lake Dam and Reservoir; Palisades Dam, Reservoir, and powerplant; 2 diversion dams; 293 miles of canals; 672 miles of laterals; 537 miles of drains; and 190 water supply wells.

Recreation on the Minidoka project has greatly increased since 1922. American Falls Reservoir and Island Park Reservoir are popular for picnicking, swimming, boating, and fishing, primarily for trout. Lake Walcott provides picnicking, boating, and some fishing.

A spectacular setting immediately adjacent to Grand Teton National Park and only a few miles south of Yellowstone National Park attracts many vacationers to Jackson Lake. Fishing, boating, swimming, camping, hiking, riding, and other outdoor sports are available in summer, and the area is becoming widely known as a winter sports center as well.

Milk River Project 1972

THE Milk River project, in northcentral Montana, has irrigation service available to about 121,000 acres of irrigable land of which 96,500 acres are irrigated. Project features are Sherburne Lake, the Nelson and the Fresno Storage Dams; the Dodson, Vandalia, St. Mary, and Swift Current Diversion Dams; the Dodson Pumping Plant, 199 miles of canals, 248 miles of laterals, and 185 miles of drains. A water supply is furnished to project lands which are divided into the Chinook, Malta, and Glasgow divisions and the Dodson Pumping Plant unit. The lands extend approximately 165 miles along the river from near Havre to a point 6 miles below Nashua. No power is developed on the project.

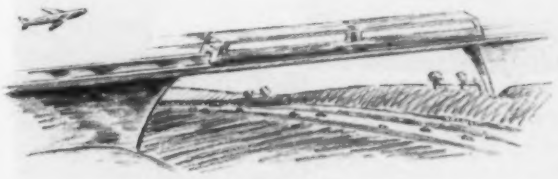
Irrigation on the Milk River project has increased greatly in recent years, as indicated by these figures beginning, in 1948:

Year	*Acres irrigated*
1948	72,000
1958	87,500
1968	97,200

Much of the grain irrigated is used to feed livestock with the remainder going to the market to be sold.

Recreation has changed since 1922. Today, Fresno Reservoir provides swimming, boating, and fishing in season for rainbow and brown trout.

Nelson Reservoir provides excellent fishing for walleyed pike and trout, and fine duck and goose hunting in season.



Recreation Land and Our Responsibility

by ROLAND V. SNOW, Recreation Resource Specialist, Washington, D.C.

Above, water's edge camping at Shadow Mountain Reservoir, Colo.-Big Thompson project is an enjoyable experience for the whole family. Right, youngsters enjoy the cool waters of Ruedi Reservoir on the Bureau's Fryingpan-Arkansas project. Below, a brisk wind from an approaching storm sends this sailboat speeding across the surface of Grand Lake, Colo.

WITH the increased leisure time many Americans are experiencing today, it is no wonder the pressures of increased usage of recreation areas are constantly mounting.

The Bureau of Reclamation's recreational empire now comprises 242 recreation areas. These include 199 storage reservoirs, 31 diversion reservoirs, and 12 non-reservoir areas. These areas contain 3.7 million acres of land and 1.5 million acres of water available for recreational use by the public.

They do not include the other project areas (mostly the irrigated land areas) that have substantial recreational values for such activities as hunting, fishing, and swimming, mostly by local residents.

Pursuant to the Bureau's historical policy, most recreational management responsibility has been transferred under formal agreement to other Federal and non-Federal agencies, as shown in figure 1. Of the 242 Reclamation recreation areas, the Bureau manages 18. The states, primarily through park departments and fish and game departments, administer 96 areas. The Forest Service is next with a total of 44 reservoirs in or adjacent to national forests.

The remaining recreation areas are distributed primarily among counties, water user organizations, the Bureau of Sport Fisheries and Wildlife, and the National Park Service. Altogether 151, or 62 percent of the 242 areas are administered by non-Federal agencies.

Visitor Days Increase

The Bureau's policy of transferring recreational management responsibility to other agencies evolved many years ago when recreational use was at a much lower level than today, and when such use generated fewer demands and problems than we cope with today. As shown in figure 2, in terms of visitor days, recreational use increased from 6.6 million in 1950 to 54.2 million in 1970, or 721 percent.

Accompanying this seven-fold increase on Bureau projects has been the need to provide appropriate facilities and adequate management capability to supervise such use and to protect the physical, environmental, and recreational resources.

It is becoming more apparent, sometimes in dramatic fashion, that these requirements are not always being met. To a large extent, the challenges that are arising with increasing frequency involve inadequate facilities, limited management capability, and austere financing, particularly among the non-Federal managing agencies.

Without adequate financing, facilities cannot be provided to accommodate the increasing public use. In addition, some non-Federal agencies, particularly counties, have not developed management capabilities to cope with the increasing responsibilities. In some instances, managing agencies have been unable to resist pressures for exploitation of recreational values by commercial interests. When this happens, private profits are maximized, and the public interest is minimized.

Legislation has been enacted during recent years which authorizes the use of Federal funds at Reclamation's recreation areas. Most significant were the Land and Water Conservation Fund Act (P.L. 88–578) and the Federal Water Project Recreation Act (P.L. 89–72). Both were enacted in 1965, and both require Federal/non-Federal cost sharing.

In addition, some acts authorizing individual projects have included consideration of recreation in project plans—for example, the Colorado River Storage project and the Fryingpan-Arkansas project.

Neither the general nor the specific legislation, however, provides for Bureau financing needed to carry out its increasing responsibilities for administration of recreation, including adequate supervision of managing agencies. Nor does the legislation recognize the need for funds for Bureau development and management of problem areas where alternative solutions are not available. However, the lack of a positive Bureau program probably cannot be blamed entirely on the absence of specific legislative authority.

It is possible that the Bureau has not utilized all the authority now available under Reclamation law to meet its growing responsibilities in recreation. We are making an effort to fill some of the gaps. At the recent program conference in San Jose, a line item was added to our program to request nonreimbursable funds for recreation operation and maintenance.

This is an innovative step in the right direction which reflects the Bureau's positive response to a growing challenge. A firm and well-supported stand will now be needed to "backstop" this and other appropriate action at higher echelons.

Private Ownership

The need for positive action by the Bureau is not limited to past inadequacies in management expertise and funding. Privately owned recreational land throughout the Nation, including the Western States, is being sold at what sometimes seem to be exorbitant prices. Because of growing demand and the limited areas of such lands, these pressures are expected to increase. The land subdivision developers who sell recreational homesites actively exploit this interest.

Reclamation's Prime Land

The market that has been established in the recreation homesite subdivision business provides a basis for measuring the value of the Bureau's recreational resources, such as the lands within our

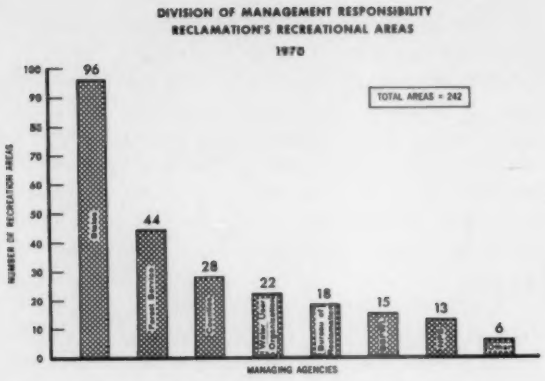


Figure 1

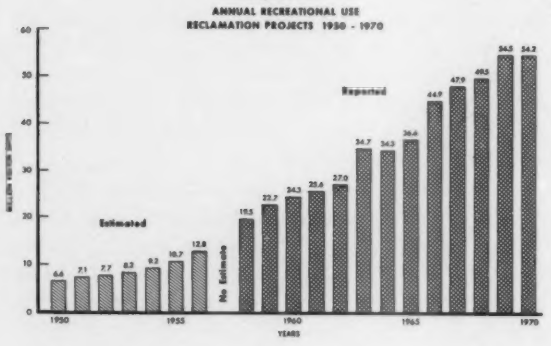


Figure 2

existing 242 recreational areas. Most of these lands would bring premium prices if available for sale, since they are waterfront property.

If we assume a price of $5,000 per acre, which could well represent a net price above selling cost, for the 3.7 million acres of land now available for public recreation use, we arrive at a market value of $18.5 billion. By comparison, the investment in all Reclamation facilities of every kind through fiscal year 1970 totaled $6 billion. As a minimum, the significance of these relationships should generate a healthy respect for the magnitude of our responsibilities in the management of our recreational resources.

Any lack of appreciation within the Bureau regarding the value of these recreational resources has not been duplicated in the business world. Profit potentials of many of our reservoir areas have been carefully assessed by land subdivision, mobile home, cabinsite, and other interests.

In at least one instance, a land subdivider nearly succeeded in blocking public access to provide his homesite purchasers exclusive use of the reservoir. He attempted this by acquiring lands surrounding the most valuable part of a reservoir. Such efforts usually become evident at those reservoirs where the recreational management capability is weak, and where little or no development of public recreational facilities has occurred.

A closely related matter involves the interests of some social or activity-oriented groups such as fraternal organizations and boat clubs, most of which have local political connections. The efforts of such groups to secure preferential rights to some of our recreational resources are often difficult to resist.

An effective and practicable response requires that any development by such interests be consistent with approved comprehensive plans and that public access to reservoir shorelines or land areas is not impaired.

Figure 3 provides some perspective on how intensively our recreation areas are used. Intensity was determined by computing, for calendar year

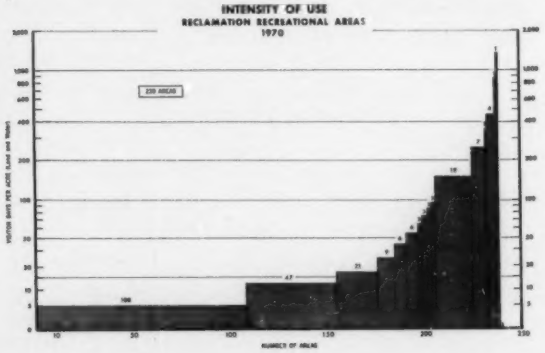


Figure 3

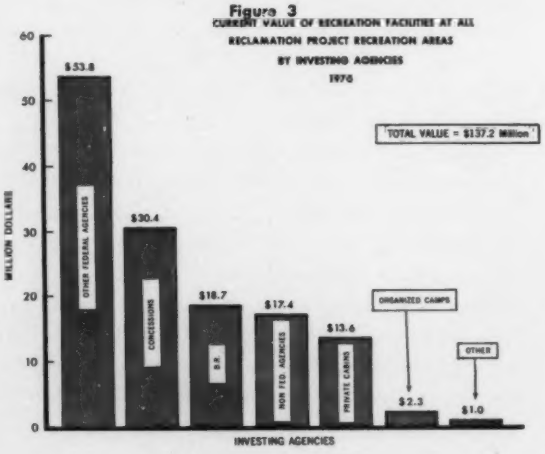


Figure 4

1970, the number of visitor days per acre of land and water available for recreation. The resulting range extended from less than one visitor day per acre at such areas as Horseshoe Reservoir on the Salt River project, Lake Powell on the Colorado River Storage project, Kesterson Reservoir on the Central Valley project, Platoro Reservoir on the San Luis Valley project, Lake Walcott on the Minidoka project, and Lake Bowdoin on the Milk River project, to the astounding maximum of 1,373 visitor days per acre that occurred last year at East Portal Reservoir on the Colorado-Big Thompson project.

Running a close second to East Portal Reservoir was Lake Estes with 877 visitor days per acre, also on the Colorado-Big Thompson project. The chart was prepared by grouping individual areas into size groups according to average visitation per acre and charted on a logarithmic scale to permit presentation on a graph of reasonable size. The groups are charted at their midpoints.

Minimal Use Areas

The most significant fact portrayed by this chart is the large number of areas with minimal use intensity. For example, of the 239 areas chartered, 108 have average intensity of five visitor days per acre, an additional 47 with 15 visitor days per acre, and 21 with an average of 25 visitor days per acre.

Where substantial development has been undertaken responsive to public use pressure, intensities of from 100 to 300 visitor days per acre are experienced. Included in this group are such as Cachuma Lake in California, Pinewood Lake in Colorado, Jamestown Reservoir in North Dakota, Lake Thunderbird in Oklahoma, Emigrant Reservoir in Oregon, Pactola Reservoir in South Dakota, East Canyon Reservoir in Utah, and Conconully Reservoir in Washington.

Most of our recreational areas are presently utilized at levels far below their potentials. This, coupled with the near certain prospect of increasing use pressures at all areas, further emphasizes our responsibility for judicious development and management, in the public interest, of these valuable recreational resources.

A reflection of the Bureau's limited investment in recreation is provided by the values of existing recreational facilities broken down to show responsible agency categories. Such values, in terms of "present worth" total $137.2 million as shown in figure 4 for calendar year 1970 for our 242 recreational areas.

The two largest investors are other Federal agencies and concessioners. Combined, they have invested $84.2 million, or 61 percent of the total. The Bureau is in third place with $18.7 million or 13.6 percent, followed by non-Federal agencies with $17.4 million or 12.7 percent. The investment of $13.6 million in private cabins is equal to over 70 percent of the Bureau's investment in public use facilities.

Our experience in recent years at areas managed by others than the Bureau indicates that inadequate management capability and the usurping of public use rights by special interests often occur where the Bureau has exercised too little administrative control or surveillance over the managing agency. Thus, it is quite clear that the Bureau's past policy is less than adequate for many of the recreational areas under management agreements with non-Federal agencies.

This is because insufficient consideration has not been given to the "party of the third part." This party is the public interest, which involves many ramifications not included in other contracts, but which the Bureau must protect, under existing policy and law. This, in my opinion, is our greatest responsibility for the recreational resources of Reclamation projects. A predictable consequence of our failure or indecision to meet this responsibility is the loss of options available to us through the inevitable transfer of our administrative duties into the political arena. # # #

This fisherman finds peace, quiet and fish aplenty along the shore of Flaming Gorge.

NEWS NOTES

Mt. Elbert Pumped-Storage Powerplant

The award for the Mt. Elbert Pumped-Storage Powerplant, a feature of the multipurpose Fryingpan-Arkansas project in Colorado, was made January 6, 1972. This plant will contain a 100,000-kilowatt reversible unit, with provision for addition of a second unit of equal size at a later date.

The contract went to Martin K. Eby Construction Co., Inc., and Equipment Rental and Sales Co., Inc. They will construct the Mt. Elbert Pumped-Storage Powerplant on the north shore of Twin Lakes, on Lake Creek, about 15 miles southwest of Leadville, Colo., some 9,200 feet above sea level. A forebay reservoir of about 10,000 acre-feet capacity will be built later on a hill above the powerplant.

Pumped storage has developed through an era of increasing concern over environmental protection. It is an efficient and reliable method of furnishing badly needed peaking power.

Bureau Aids Recycling Program

The Bureau of Reclamation has agreed to amend a water service contract with the Contra Costa County Water District in California to facilitate the district's participation in a major waste water recycling program.

This imaginative water recycling program supported by the Administration could be a model operation for the conservation of water resources in many of our arid and semiarid areas.

The program is designed to provide renovated water for further beneficial use, and the interception of sewage pollution will aid in improving water quality in the California Delta.

James R. Smith, Assistant Secretary—Water and Power Resources, said the water district has directed its efforts since enactment of the Water Quality Act of 1965 to development of a Water Resources management-Pollution Control concept.

The purpose is to conserve water resources in the Central Valley project and to avoid construction of water projects, when feasible, by intercepting and treating stream-polluting domestic sewage and reclaiming it for industrial uses and open space irrigation.

Participants in the program include the Contra Costa County Water District, Central Contra Costa Sanitary District, California State Water Resources Control Board, and the Environmental Protection Agency.

The recycling program is expected initially to make 20,000 acre-feet of reclaimed water available annually, reducing by that amount the supply required by the Water District, at least in the early years of operation.

Commissioner Armstrong Elected Chairman

Commissioner Armstrong was elected chairman of the U.S. National Committee of the World Energy Conference for a 2-year term. Commissioner Armstrong served as vice-chairman—International Division of the National Committee during the past 2 years.

His elevation to the chairmanship was voted at El Paso, Tex., at a meeting of the U.S. National Committee. He succeeds F. Norman Woodruff, manager of gas proration operations, El Paso Natural Gas Co.

The U.S. National Committee has the objective of better serving national energy requirements and is also preparing for the Ninth World Energy Conference, which will be held in Detroit, Mich., in September 1974.

Record Reclamation Programs—1972 and 1973

The Congress has approved requests for supplemental appropriations for fiscal year 1972, totalling $16,610,000 for the Bureau of Reclamation. This means the Bureau now has a total approved 1972 program of $401,039,000, the first for any year to exceed $400 million.

But, this will not be a one-time occurrence. The appropriation request submitted to Congress for the fiscal year 1973 budget was $516,031,000, which greatly surpasses our 1972 record year. If this is approved by Congress, it will make possible acceleration of work on such projects as Central Valley, Fryingpan-Arkansas, Bonneville unit, Palmetto Bend, Garrison Diversion unit, and many others.

Arizona Projects Office in Phoenix

The Bureau of Reclamation is realigning its activities in central Arizona with the establishment of an Arizona Projects Office in Phoenix.

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The new office will handle all preconstruction and construction activities for the central Arizona project as well as certain other Reclamation functions to be assigned.

The Phoenix Development Office was deactivated and selected personnel from that office were assigned to the Arizona Projects Office.

Key personnel include C. A. Pugh, projects manager; Richard E. Shunick, associate projects manager; O. H. Lillard, division of planning; Robert W. Gilbert, former assistant to the regional director, region 4, headquartered in Salt Lake City, Utah; A. K. Dolyniuk, former construction engineer in the Parker-Davis Project Office in Phoenix; and M. C. Thomas, formerly office engineer for the Southern Nevada Water Project, Henderson, Nev.

These men were carefully selected from the ranks of Reclamation's career employees to form the nucleus of a highly trained engineering and administrative organization to handle the complex duties associated with the Bureau's huge water development program in Arizona.

Men Who Made Marks in 1971

On February 9, the Commissioner was honored at a dinner sponsored by *Engineering-News Record* magazine held in New York. He was named by *ENR* as one of several "Men Who Made Marks in 1971," for his work in pushing underground excavation technology including the proposed Stillwater Tunnel underground excavation research.

Answers to Water Quiz

1. c; 2. a, This was discovered by Dr. Harold Urey in 1934; 3. c; 4. c; 5. b.

MAJOR RECENT CONTRACT AWARDS

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-6884	Central Valley, Calif.	Feb. 8	Armature winding for generator unit 3, Shasta powerplant.	McGraw-Edison Co., National Electric Coil Division, Columbus, Ohio.	$224,464
DC-6915	Fryingpan-Ark., Colo.	Jan. 6	Mount Elbert pumped-storage powerplant	Martin K. Eby Construction Co., Inc. and Equipment Rental and Sales Co., Inc., d.b.a. Eby & Co., Wichita, Kans.	16,239,483
DS-6917	Columbia Basin, Wash.	Feb. 24	Primary unit substation for Grand Coulee 11.95-kilovolt switchyard.	United Power & Control Systems, Inc., Seattle, Wash.	359,259
DC-6918	Colorado River Storage, Wyo.-Colo.	Jan. 12	Archer-Weld 230-kv transmission line, stage 1	Malcolm W. Larson Contracting Co., Inc., Colorado Springs, Colo.	1,407,895
DC-6919	Navajo Indian Irrigation, N. Mex.	Jan. 17	Siphons, tunnel, concrete-lined canal and access roads, main canal, station 1067+00 to station 1105+00 and station 1398+75 to station 1732+00. Schedules No. 2 and 3.	Vinnell Corp., Alhambra, Calif.	14,753,240
DC-6920	Colorado River Storage, Colo.	Jan. 6	Crystal Dam diversion tunnels	Al Johnson Construction Co., Minneapolis, Minn.	1,578,965
DS-6921	Middle Rio Grande, N. Mex.	Mar. 7	Aerial photography, rectified photographs, cross-section data, Rio Grande, miles 20 to 206 and topographic map compilation, Cochiti Dam and reservoir area. Negotiated.	Limbaugh Engineers, Inc., Albuquerque, N. Mex.	228,552
DC-6925	Central Valley, Calif., San Luis Unit, West San Joaquin Div.	Mar. 2	Earthwork, pipelines and structures for Westlands Water District distribution system laterals 14, 15, 17, 19, 27, 33 and 34. Schedule No. 1.	Perini Corp., San Francisco, Calif.	10,049,400
DC-6926	Central Valley, Calif.	Feb. 7	Earthwork, concrete lining and structures, Tehama-Colusa canal reach 1, station 662+00 to station 733+00.	Gordon H. Ball, Inc., Danville, Calif.	1,804,790
100C-1187	Columbia Basin, Wash.	Jan. 14	Drains—block 85	John M. Keltch, Inc., Pasco, Wash.	347,374
100C-1188	do	Jan. 3	D78-102, D78-106, D78-106-2, and D78-107 drain systems and D78-101 drain extensions, block 78.	Equipco Contractors, Inc., Ephrata, Wash.	208,710
100C-1191	do	Jan. 27	Drains—blocks 16 and 161, schedules No. I, 1B, II, and IIB.	George A. Grant, Inc., Richland, Wash.	452,883
200C-837	Central Valley, Calif.	Jan. 3	O'Neill Forebay recreation facilities phase II	Mann Construction Co., Inc., Redmond, Oreg.	673,265

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